

University of Groningen

## Algebraic connection theory of L-modules

Ruiter, Jan de

**IMPORTANT NOTE:** You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

*Document Version*

Publisher's PDF, also known as Version of record

*Publication date:*

1972

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

Ruiter, J. D. (1972). Algebraic connection theory of L-modules. s.n.

**Copyright**

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

**Take-down policy**

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

## EPILOGUE

It is not clear how to carry over the covariant part of the theory as expounded in (8) - that is the part dealing with dual F-modules - to the corresponding L-case. The problem is that if we follow Nelson's definition of the dual of an F-module (see (8) p. 1) the dual of an L-module is itself not an L-module. Consider to that end an L-module  $M$  and let  $M'$  be the set of all module homomorphisms  $\omega : M \rightarrow L$ , denoted by  $m \mapsto \langle \omega, m \rangle$ . It is obvious that  $M'$  is a vector space but we cannot define a module composition  $L \times M' \rightarrow M'$  by setting

$$\langle l\omega, m \rangle = l\langle \omega, m \rangle.$$

Nevertheless it is striking that many contravariant algebraic aspects of manifolds and especially of connections and curvature are not restricted to manifolds.

Another question raised by the theory is the following one: how far are differentiable functions and differentiable fields on a differentiable manifold dual to each other? It is clear that a certain form of duality between functions and fields exists since they have the structure of an F-module as well as of an L-module. The module compositions are  $(f, X) \mapsto fX$  respectively  $(X, f) \mapsto Xf$ , where  $f$  is a function and  $X$  a field. As we have seen both structures generate analogous theories. The theory corresponding to the first case can be applied to manifolds but we do not know whether it is possible in the second case or not.